

National Marine Fisheries Service (NMFS)
Application for a Scientific Research/Enhancement Permit under Section 10(a)(1)(A) of
the Endangered Species Act of 1973

A. Title: Application for Permit for Scientific Purposes and to Enhance the Propagation or Survival of Listed Species under the Endangered Species Act of 1973

B. Species: Snake River Sockeye Salmon (*Oncorhynchus nerka*)

C. Date: 1 December 2002

D. Applicant Identity: Virgil Moore, Chief, Bureau of Fisheries
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E. Information on Personnel, Cooperators, and Sponsors.

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2. Field Personnel:

3. Project Funding: Bonneville Power Administration
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4. Contractor Activities: none

5. *Disposition of tissue samples, dead specimens, or other remains:*

Select mortalities are frozen or preserved as appropriate for genetic or other analyses. Select specimens may also be preserved (e.g., preserved in formalin, tanned, preserved by taxidermy, etc.) for future use for research or educational purposes. The NMFS and other sponsors and cooperating institutions involved with the Redfish Lake Sockeye Salmon Captive Broodstock Program may display preserved specimens in government offices, universities, and other public places for purposes of education and public outreach. Specimens not vital to analysis, outreach education, or restoration are incinerated, rendered, or buried.

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6. *Qualifications and experience of all staff responsible for care without supervision:*

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The project Hatchery Manager is Dan Baker. Mr. Baker has worked for IDFG since 1989 in resident and anadromous fish hatcheries. He began in chinook salmon and steelhead production and continued into resident rainbow production. Mr. Baker is hatchery manager at IDFG's Eagle Fish Hatchery where he manages the sockeye salmon recovery effort and chinook captive rearing program responsibilities. He received his B.S. in Fishery and Wildlife Biology from Iowa State University in 1987. Prior to coming to IDFG, Mr. Baker worked temporary positions with the United States Fish and Wildlife Service and for Indiana Department of Natural Resources. During this time with his temporary positions, he worked in fisheries research and warm water fish management.

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The project Principal Investigator is Paul Kline. Mr. Kline has worked for IDFG since 1992 in resident and anadromous fisheries research sub-sections. He has been affiliated with salmon recovery programs since 1993. In addition to sharing chinook captive rearing program responsibility, Mr. Kline is currently principal investigator for IDFG's sockeye salmon recovery effort. Prior to assuming management responsibility for IDFG captive propagation programs, Mr. Kline served as sockeye project Research Biologist. In this capacity, he coordinated all evaluation activities associated with *O. nerka* population monitoring, juvenile out-migrant monitoring, pre-spawn adult volitional spawning investigations, life history investigations, and kokanee fishery monitoring. He received his B.S. and M.S. in Natural Resources and Fisheries from Humboldt State University (1975, 1980). Prior to coming to IDFG, Mr. Kline worked for the United States Forest Service and for a private consulting firm in northern California. During his years in the consulting business, Mr. Kline was lead

investigator on numerous fishery habitat and population surveys of coastal salmon and steelhead systems.

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The Research Biologist for the project is Lance Hebdon. Mr. Hebdon has held this position since 1999. This position is responsible for field supervision of juvenile sockeye salmon out-migration trapping and tagging, adult sockeye salmon tagging and spawning observations, releases of adults and juveniles back to the habitats and life history investigations. He received B.S. in Ecology from Idaho State University (1995) and M.S. in Zoology and Physiology from the University of Wyoming (1999). He holds Associate Fisheries Professional certification from the American Fisheries Society. Prior to coming to IDFG Mr. Hebdon worked for the University of Wyoming as a Research Associate.

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The Fish Hatchery Assistant Manager for the Eagle Fish Hatchery is Jeff A. Heindel. Mr. Heindel has worked for IDFG since 1991 in Department-operated resident and anadromous fish hatcheries, and has been affiliated with salmon recovery programs since 1998. In his current position as Fish Hatchery Assistant Manager, Jeff shares the management tasks of all hatchery-related components of the captive propagation programs (sockeye/chinook) including: facility management, staff supervision, field supervision, propagation activities, general culture duties, maintenance of databases, as well as the development and monitoring of budgets. He received his Bachelors of Science degree from Boise State University in 1995.

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Keith Johnson serves as fish pathologist and technical advisor for the sockeye program. Dr. Johnson received his B.S. (1966) from the University of Idaho, his M. S. (1968) from Montana State University and his PhD from Oregon State University (1975). Dr. Johnson has worked in fish culture and fish health for 24 years. Dr. Johnson is currently Fish Health Manager for IDFG. Prior to assuming this position, Dr. Johnson served as principal investigator on the Sockeye Salmon Captive Brood Stock Program.

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Catherine has worked for the Idaho Department of Fish and Game sockeye salmon and chinook salmon captive hatchery programs since October of 2000. She assists with hatchery activities, maintains hatchery records, conducts field activities, and assists with report writing. In addition, Catherine shares fish transportation responsibilities with Eagle Hatchery staff. Prior to her employment with the IDFG, she served as a Fisheries Technician at a resident trout hatchery and then as Assistant Fisheries Biologist for the North Carolina Wildlife Resources Commission. Other previous employment includes working as a seasonal Fisheries Technician for the Colorado Division of Wildlife and as a Research Assistant at the Aquatic Ecotoxicology Laboratory at Colorado State University. She received her B.S. degree in Wildlife Biology in 1997 from Colorado State University.

F. Project Description, Purpose, and Significance

1. Justification of the objective(s): motivation, history, goals, etc. and how the wild populations of the species will benefit from the proposed activities.

Snake River sockeye salmon *Oncorhynchus nerka* were listed as endangered under the Endangered Species Act (ESA) by the National Marine Fisheries Service (NMFS) on November 20, 1991. Residual (nonmigratory) sockeye salmon were discovered in Redfish Lake and added to the listing in 1992.

In Idaho, only the lakes of the upper Salmon River (Sawtooth basin) remain as potential sources of production for sockeye salmon. Historically, five Sawtooth basin lakes (Redfish, Alturas, Pettit, Stanley, and Yellowbelly) supported sockeye salmon (Bjornn et al. 1968). At the time of listing Redfish Lake was the only lake in the Snake River Basin that still had returning anadromous adult sockeye salmon.

Snake River sockeye salmon were described by Waples (1991) as a prime example of a species on the threshold of extinction. Based on the critically low numbers of returning adults IDFG, NMFS, Shoshone-Bannock Tribes and BPA initiated a captive broodstock project as an emergency action to prevent extinction of this unique sockeye salmon population. Near-term goals for the project are to avoid species extinction using captive broodstock technology, maximize diversity, and avoid risks associated with selection, inbreeding, and genetic drift.

Captive propagation of animals to maximize their survival and reproductive potential has won acceptance in endangered species restoration (Gipps 1991; Johnson and Jensen 1991; DeBlieu 1993; Olney et al. 1994; Flagg and Mahnken 1995). These efforts range from establishment of free-roaming breeding colonies on localized preserves to full-term captive rearing (Gipps 1991; Johnson and Jensen 1991; DeBlieu 1993; Olney et al. 1994; Flagg et al. 1995). Full-term rearing of captive broodstocks maximizes potential production of juveniles for enhancement. The relatively short generation time of Pacific salmon and their potential to produce large numbers of offspring make them suitable for captive broodstock rearing. Survival advantages offered through protective culture can

be significant. Theoretically, survival of fish reared in protective captive broodstock culture can exceed wild survival by 100-to-1,000 fold (Flagg et al. 1995). The substantial survival advantage for captive-reared fish provides potential to produce large numbers of juveniles to amplify the natural population during the second generation.

The Redfish Lake captive broodstock project has been underway since 1991. To reduce the risk of catastrophic loss of this valuable gene pool, complementary broodstocks are reared by IDFG in Idaho and by NMFS in Washington. Spawning has occurred in the sockeye salmon captive broodstock program since 1991. Wild anadromous females were spawned in 1991, 1993, 1994, and 1996. Egg survival to the eyed stage of development for wild female parents has averaged 76%. Hatchery-produced adult sockeye salmon have been spawned yearly since 1994. Egg survival to the eyed stage of development has been variable (39% to 73%) but has averaged 55%. Summarized spawning results for the history of the program are presented in Table 1.

Table 1. Results of captive brood spawning organized by spawn year.

Spawn year	Female origin	Female brood year ¹	Number green eggs	Number eyed-eggs	Mean fecundity	Survival to eyed stage
1991	Wild anadromous	Unknown	2,177	1,978	2,177	91%
1992	Wild Residual (1)	Unknown	36	36	—	100%
1993	Wild anadromous	Unknown	6,320	3,699	3,160	58%
1993	Wild out-migrants	1991	32,956	9,656	2,059	29%
1993	Wild residuals	Unknown	317	292	158	92%
1994	Hatchery-produced	1991	466,830	256,756	1,995	55%
1994	Wild anadromous	Unknown	2,896	2,780	2,896	96%
1995	Hatchery-produced residuals	1992	3,289	1,349	1,644	41%
1995	Wild out-migrants	1992	2,079	1,156	2,079	56%
1995	Wild out-migrants	1993	1,080	501	1,080	46%
1996	Hatchery-produced	1993	180,000	109,000	2,118	61%
1996	Wild anadromous	Unknown	2,067	1,756	2,067	85%
1997	Hatchery-produced	1994	253,673	152,760	2,205	60%
1998	Hatchery-produced	1996	32,375	15,580	1,199	48%
1999	Hatchery-produced anadromous	1996	1,469	1,370	1,469	93%
1999	Hatchery-produced	1996	160,436	61,798	1,976	39%
2000	Hatchery-produced	1997	377,550	214,298	2,924	57%
2000	Hatchery-produced anadromous	1996	44,151	32,022	2,772	73%
2000	Hatchery-produced	1998	11,603	6,727	1,527	58%
2001	Hatchery-produced anadromous	1997	5,374	3,199	2,743	60%
2001	Hatchery-produced	1998	277,060	114,920	2,213	41%
Totals			1,863,738	991,633		

¹ Indicates year trapped for out-migrants.

Cryopreservation of sperm from male donors has been conducted in the Redfish Lake Sockeye Salmon Captive Broodstock Program since 1991 and follows techniques described by Cloud et al. (1990) and Wheeler and Thorgaard (1991). Beginning in 1996, cryopreserved sperm was used to produce specific lineage broodstocks for use in future

spawn years. “Designer broodstocks” produced in this manner help to maximize the genetic variability available in future spawn years.

Sperm from all wild anadromous sockeye salmon (16 males), wild out-migrants brought into the program between 1991 and 1993, residual sockeye salmon, and unique hatchery-produced adults has been cryopreserved. Cryopreserved milt is archived at the Eagle Fish Hatchery, the University of Idaho, and Washington State University. Currently, 1,681, 0.5 ml straws of sockeye salmon milt representing 68 unique males are in storage at the Eagle Fish Hatchery, 90, 0.5 ml straws representing 9 unique males are in storage at Washington State University and 1,490, 0.5 ml straws representing 118 unique males are in storage at the University of Idaho.

Since the inception of the program in 1991, the development of egg and fish reintroduction plans has followed a “spread-the-risk” philosophy incorporating several release strategies and multiple lakes. Release strategies were developed by SBSTOC cooperators and reflect tested techniques applied in the commercial aquaculture field as well as in State, Provincial and Federal agency programs. The program’s reintroduction history is summarized below by major release strategy.

Eyed-egg planting In 1995, the SBSTOC recommended that IDFG incorporate an eyed-egg planting strategy (and evaluation) into the annual program release design. With subsequent NMFS approval through the Section 10 permit process, this strategy was first implemented in 1996. Eggs destined for this release option are produced at the IDFG Eagle Fish Hatchery and NMFS facilities. A complete history of eyed-egg plants and estimated hatch results is presented in Table 2.

Table 2. Redfish Lake Sockeye Salmon Captive Broodstock Program eyed-egg release history and estimated hatch results.

Release year	Release location	No. of eggs planted	Estimated hatch
1996	Redfish Lake	105,000	97%
1997	Redfish Lake	85,378	98%
	Alturas Lake	20,389	72%
1999	Pettit Lake	20,311	74%
2000	Pettit Lake	65,200	79%
2002	Pettit Lake	30,924	na
Total		327,202	

Presmolt planting The first releases of age 0, hatchery-produced juvenile sockeye salmon (presmolts) to Stanley basin lakes occurred in 1994. Since that time, Redfish Lake has received presmolt plants yearly. Three presmolt release strategies have been employed in Redfish Lake: a summer direct-lake release, a fall direct-lake release, and a fall release from a net pen environment. In 1995 and 1997, Pettit and Alturas lakes were incorporated in annual release and evaluation activities. Both lakes have received summer and fall, direct-lake introductions of presmolts. Presmolt release groups are generated from eggs produced at the IDFG Eagle Fish Hatchery and NMFS facilities.

Rearing through release takes place at the IDFG Eagle and Sawtooth fish hatcheries. A presmolt supplementation history is presented in Table 3.

Table 3. Redfish Lake Sockeye Salmon Captive Broodstock Program presmolt release history.

Location	Release Date	Strategy	Release time	Number Released	Mean weight (g)
Redfish	8/3/1994	Net pen	Summer	11,130	8.2
Redfish	11/23/1994	Direct-lake	Fall	2,989	8.1
Redfish	10/10/1995	Net pen	Fall	28,163	11.4
Redfish	6/29/1995	Direct-lake	Summer	27,179	5.8
Redfish	10/5 & 10/1995	Direct-lake	Fall	27,703	16.1
Pettit	7/27/1995	Direct-lake	Summer	8,527	7.4
Redfish	10/7/1996	Net pen	Fall	1,932	22.0
Redfish	10/21/1997	Net pen	Fall	62,907	21.1
Redfish	7/14/1997	Direct-lake	Summer	21,036	9.6
Redfish	10/15/1997	Direct-lake	Fall	68,379	21.0
Pettit	7/1/1997	Direct-lake	Summer	8,643	8.7
Alturas	10/16/1997	Direct-lake	Fall	72,496	21.0
Alturas	7/15/1997	Direct-lake	Summer	22,250	8.4
Redfish	10/1/1998	Net pen	Fall	55,830	14.4
Redfish	10/14/1998	Direct-lake	Fall	39,418	10.6
Pettit	7/15/1998	Direct-lake	Summer	7,246	9.8
Alturas	10/14/1998	Direct-lake	Fall	39,377	10.3
Redfish	10/6/1999	Direct-lake	Fall	23,886	9.7
Pettit	10/6/1999	Direct-lake	Fall	3,430	10.4
Alturas	10/6/1999	Direct-lake	Fall	12,955	10.8
Redfish	10/11/2000	Direct-lake	Fall	48,051	10.8
Pettit	7/31/2000	Direct-lake	Summer	6,007	8.5 & 2.9
Pettit	10/11/2000	Direct-lake	Fall	6,067	13.9
Alturas	7/31/2000	Direct-lake	Summer	5,986	8.5 & 2.9
Alturas	10/11/2000	Direct-lake	Fall	6,003	12.8
Redfish	10/8/2001	Direct-lake	Fall	41,529	10.8
Redfish	10/10/2001	Net pen	Fall	41,474	30.0
Alturas	7/27 & 31/2001	Direct-lake	Summer	6,123	14.5 & 4.0
Alturas	10/9/2001	Direct-lake	Fall	5,990	14.0
Pettit	7/27 & 31/2001	Direct-lake	Summer	6,057	14.4 & 4.0
Pettit	10/9/2001	Direct-lake	Fall	4,993	15.4
Redfish	8/28 & 29/2002	Direct-lake	Summer	61,500	11.4
Redfish	10/7/2002	Direct-lake	Fall	45,001	15.3
Pettit	8/27/2002	Direct-lake	Summer	7,805	11.4
Pettit	10/8/2002	Direct-lake	Fall	19,981	30.7
Alturas	8/27/2002	Direct-lake	Summer	6,123	10.6
Total				864,166	

Smolt planting Hatchery-produced smolt releases were incorporated in the release design and evaluation in 1995. Two release locations have been used: Redfish Lake Creek and the upper Salmon River. Smolt release groups are generated from eggs produced at the IDFG Eagle Fish Hatchery and the NMFS-operated Big Beef Creek Hatchery. Rearing through release takes place at the IDFG Sawtooth fish hatchery. In addition, the Oregon Department of Fish and Wildlife's Bonneville fish hatchery has been used to rear juvenile sockeye salmon for release as smolts. A smolt supplementation history is presented in Table 4.

Table 4. Redfish Lake Sockeye Salmon Captive Broodstock Program smolt release history.

Release location	Date released	Number released	Number PIT-tagged	Mean release weight
Redfish Lake Creek	4/21/1995	3,794	1,371	177.5
Redfish Lake Creek	5/2/1996	11,545	1,990	50
Redfish Lake Creek	4/28, 5/4/98	37,583	2,000	26.5 g & 63.5
Upper Salmon River	4/28, 5/4/98	44,032	1,999	26.5 g & 63.5
Redfish Lake Creek	5/5/1999	4,859	400	25.4
Upper Salmon River	5/4/1999	4,859	400	25.4
Redfish Lake Creek	5/9/2000	148	148	258
Redfish Lake Creek	5/2/2001	13,915	1,000	49.4
Redfish Lake Creek	5/7/2002	38,672	995	27.6
Total		159,407		

Pre-spawn adult planting Pre-spawn adult sockeye salmon from the Redfish Lake Sockeye Salmon Captive Broodstock Program were first released to Stanley basin waters in 1993. Since that time, adult releases have occurred in 1994, 1996, 1997, and yearly since 1999. For release years 1993, 1994, 1996, and 1997, all pre-spawn adults released for natural spawning were reared through release (full-term) at IDFG and NMFS hatcheries. Beginning in 1999 release groups consisted of full-term hatchery adults and returning hatchery-produced anadromous adults. A summary of pre-spawn adult releases is presented in Table 5.

The Redfish Lake captive broodstock project has reached its goal of building the captive population as a safety net to maintain the gene pool. A secondary focus of the program is to produce captive broodstock progeny that can be used in release efforts designed to increase anadromous sockeye salmon returns to the Stanley basin. These restoration efforts have returned 7 anadromous adults in 1999, 257 adults in 2000, 26 adults in 2001, and 23 adults in 2002 to Stanley basin lakes. These returns demonstrate that the captive broodstock project is succeeding as a safety net program that has the ability to increase the numbers of returning anadromous sockeye salmon. It is virtually certain that without the boost provided by the captive broodstock program, Redfish Lake sockeye salmon would have become extinct.

Table 5. Redfish Lake Sockeye Salmon Captive Broodstock Program prespawn adult release history.

Release Lake	Rearing origin	Date released	Number released	Number of suspected redds
Redfish	Full-term hatchery	1993	20	Unknown
Redfish	Full-term hatchery	1994	65	One behavioral observation
Redfish	Full-term hatchery	1996	120	30 suspected redds
Redfish	Full-term hatchery	1997	80	30 suspected redds
Pettit	Full-term hatchery	1997	20	1 suspected redd
Alturas	Full-term hatchery	1997	20	Test digs only
Redfish	Full-term hatchery	1999	18	8 suspected redds
Redfish	Hatchery-produced anadromous	1999	3	
Redfish	Full-term hatchery	2000	36	20 to 30 suspected redds
Redfish	Hatchery-produced anadromous	2000	120	
Pettit	Hatchery-produced anadromous	2000	28	Redds suspected but not visible
Alturas	Full-term hatchery	2000	25	14 to 19 suspected redds
Alturas	Hatchery-produced anadromous	2000	52	
Redfish	Hatchery-produced anadromous	2001	14	12- 15 suspected redds
Redfish	Full-term hatchery	2001	55	
Redfish	Hatchery-produced anadromous	2002	12	10 suspected redds
Redfish	Full-term hatchery	2002	178	
		Total	866	

2. *Statement of whether the proposed project or program responds directly or indirectly to a recommendation or requirement of a Federal agency (include citations if applicable).*

The project directly responds to several Federal agency recommendations and requirements. First, Redfish Lake sockeye salmon are listed as endangered under the United States Endangered Species Act (ESA) of 1973 which states:

“All Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this Act” (Sec. 2(c)).

Furthermore, the ESA recognizes these conservation efforts may include forms of artificial propagation, such as captive brood stocking, in the statement:

“The use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary. Such methods and procedures include, but are not limited to, all activities associated with scientific resources management such as research, census, law enforcement, habitat acquisition and maintenance, propagation, live trapping, and transplantation” (Sec. 3(3)).

In addition to being a direct requirement under ESA mandate, the Redfish Lake sockeye salmon captive broodstock program is a required reasonable and prudent action (Item

177) in the NMFS 2000 FCRPS Biological Opinion. The implementation and refinement of captive broodstocks for the recovery of Snake River sockeye salmon were identified as priorities in the 1994 Northwest Power Planning Council's (NWPPC) Columbia Basin Fish and Wildlife Program (7.4A.1-3), are part of the overarching and regional objectives of the 2000 NWPPC Columbia Basin Fish and Wildlife Program, and are priorities described in the NMFS proposed Recovery Plan for Snake River salmon.

3. *Statement of whether the proposed project or program has broader significance than the individual project's goals, or is part of a larger scale research management or restoration plan.*

The Redfish Lake sockeye salmon captive broodstock program is an integral part of the goal to recover and delist Snake River sockeye salmon as described in the NMFS Proposed Recovery Plan for Snake River Salmon (Schmitt et al. 1995) described under the plan's biological objective:

“4.1 Biological objective: Conserve remaining Snake River Salmon gene pools through implementation of captive broodstock/supplementation/gene banking programs.”

The program is part of a cooperative restoration effort being conducted by the NMFS, the Bonneville Power Administration, the State of Idaho, and the Shoshone-Bannock tribes.

4. *Description of relationships or similarities of the proposed activities to other proposed or ongoing projects and programs, and whether potential exists to cooperate and coordinate with other similar activities.*

The Snake River sockeye salmon captive broodstock project is part of a joint regional effort by the Idaho Department of Fish and Game, National Marine Fisheries Service, Shoshone-Bannock tribes, and Bonneville Power Administration to restore a healthy population of anadromous sockeye salmon to the Snake River. The project's success has been an outcome of the excellent cooperation occurring between the partner agencies. The Stanley Basin Sockeye Salmon Technical Oversight Committee (SBSTOC) coordinates the activities of the various agencies involved in these restoration efforts.

The following projects deal directly with the proposed activities or share technology and information. The IDFG and Shoshone-Bannock Tribe projects described below are identified in the Salmon Subbasin Summary. The Washington Department of Fish and Wildlife and Oregon Department of Fish and Wildlife projects are identified in the Columbia Plateau Province, Tucannon Subbasin, and Blue Mountain Province, Grande Ronde Subbasin summaries, respectively. The University of Idaho and National Marine Fisheries Service projects will be described in the Systemwide Province, Systemwide Subbasin Summary.

Idaho Department of Fish and Game Captive Rearing Initiative for Salmon River Chinook Salmon (Project No. 199700100 and 199801002). This program takes juveniles from the wild and rears them to maturity in captivity. Once mature the fish are released back to natal streams to spawn naturally. The program focuses on

efforts to develop culture techniques with chinook salmon that will develop a mature fish to increase numbers of adult spawners in locally depressed stocks.

National Marine Fisheries Service Redfish Lake Sockeye Salmon Captive Brood Stock Program (Project No. 199204000). The sockeye salmon project is in place to protect the remnant Redfish Lake population by developing captive brood stocks to meet reintroduction and brood stock objectives. Spawning protocols are designed to maximize the existing genetic diversity of the population. Eyed-eggs, juveniles, and adults are produced annually for reintroduction to the habitat. Genetically diverse progeny are generated annually to maintain the captive component.

Shoshone-Bannock Tribes Salmon River Production Program (Project No. 199705700). This project utilizes hatchery brood stock to supplement and reintroduce chinook salmon and steelhead eggs, fry, presmolts, smolts and adults in the upper South Fork Salmon River, Lemhi River, East Fork Salmon River, Yankee Fork, and upper Salmon River. This program assists the IDFG chinook salmon captive rearing project by outplanting F₁ generation eyed-eggs to incubation boxes in three target streams. In the past, eyed-eggs have been available for out planting from hatchery spawning conducted to address demographic, genetic, and environmental risks to target populations or to generate information on the reproductive success of adults reared full-term in the hatchery. This projects also assists with adult chinook outplanting, behavior monitoring, and redd count monitoring.

Oregon Department of Fish and Wildlife Grande Ronde Spring Chinook Captive Brood Stock Program (Project No. 199801001). The Oregon Department of Fish and Wildlife initiated a captive brood stock program with brood year 1994 Grande Ronde basin chinook to prevent extinction of three populations, provide a future basis to reverse the decline in stock abundance, and ensure a high probability of population persistence into the future. This program differs from the IDFG program in that it emphasizes captive brood stock rather than captive rearing methods. Collectively, both programs aim at maintaining Snake River basin chinook salmon metapopulation structure, while investigating two forms of captive propagation and determining their future utility. Oregon hatchery and research staff are generally present at Chinook Salmon Captive Propagation Technical Oversight Committee (CSCPTOC) meetings. Information related to hatchery protocols, fish health, gamete preservation, reproductive characteristics, and field research are frequently exchanged.

Washington Department of Fish and Game Tucannon River Spring Chinook Captive Brood Stock Program (Project No. 200001900). Consistent with Oregon captive intervention actions, this project aims to increase the production of smolts released to the Tucannon River between 2002 and 2008. Program staff from Washington are generally present at CSCPTOC meetings. The technical exchange that occurs at these meetings benefits IDFG, Oregon, and Washington programs.

National Marine Fisheries Service Manchester Spring Chinook Brood Stock Project (Project No. 199606700). The National Marine Fisheries Service (NMFS) is maintaining captive brood stocks of ESA-listed Snake River spring/summer chinook salmon to compliment the program with a saltwater rearing program and to spread the risk of catastrophic loss at one facility. The NMFS rears smolts received from

IDFG through early maturation. Maturing adults are returned to the IDFG Eagle Fish Hatchery for final maturation in fresh water prior to out planting to target streams. Rearing protocols are coordinated through the CSCPTOC.

National Marine Fisheries Service Assessment of Captive Brood Stock Technology (Project No. 199305600). This ongoing research project develops information needed to overcome some of the problems that limit the yield of viable adults and offspring from Pacific salmon stocks reared in captivity, and assesses some of the genetic consequences of captive brood stock programs. The overall goals of this project are: 1) to develop diets, rearing regimes, hatchery practices, and drug therapies that improve survival of adults to spawning, gamete quality, and viability of offspring that can be applied to captive brood stock programs for depressed stocks of Pacific salmon; 2) to assess quantitative genetic risks of captive brood stock programs to natural populations; and 3) to develop reintroduction strategies for captive-reared fish. Results from this research will be published in peer-reviewed journals, annual reports, and scientific meetings.

National Marine Fisheries Service NATURES (Project 199105500). This project develops and evaluates fish culture techniques (raceway habitat, predator avoidance training, exercise, live food diets, etc.) designed to increase the post release survival of artificially propagated salmon. Research findings are periodically reviewed and discussed at SBSTOC meetings.

National Marine Fisheries Service Monitor and Evaluate Genetic Characteristics of Supplemented Salmon and Steelhead (Project 199909600). This program is in place to evaluate the effects of out planting hatchery-reared fish on natural and wild populations of spring/summer chinook salmon and steelhead in four major drainages within the Snake River basin. The two major goals are to evaluate the nature and extent of genetic changes in hatchery stocks to be used for out planting and to quantify the genetic impact of out planting on targeted natural stocks and non-targeted wild stocks. In addition, this program provides genetic sex assay support for the IDFG captive chinook program.

University of Idaho Genetic Analysis of *Oncorhynchus Nerka* – Modified to Include Chinook Salmon (Project No. 199009300). This project develops mitochondrial DNA, and nuclear DNA markers for sockeye salmon populations held in the program. Molecular markers developed in this program are being used to construct breeding matrices and assist in evaluating unmarked out-migrant production.

5. *Justification for using listed species and possible alternatives to using listed species.*

The listed species was taken into captivity in 1991 to prevent its extinction. The captive breeding program now maintains a segment of the population in a captive breeding program as a safety net to ensure the population does not incur increased risk of extinction in successive year periods when no fish return from the sea. In addition, the captive culture program also provides large number of eggs, juvenile, and adult fish for release back into Stanley basin lakes to aid in recovery. There is no viable other alternative to using the listed species in these gene banking and recovery efforts.

G. Project Methodology

1. *Proposed duration of the project or program, including start and end dates.*

The duration of the captive broodstock program will ultimately be determined by the recovery program the Technical Recovery Team (TRT) for Snake River Sockeye Salmon develops. In the interim, the project is following the recovery goals established by the earlier Recovery Plan (Schmitt et al. 1995) proposed for Snake River salmon that called for multiple generations of captive broodstocks to help maintain and enhance Redfish Lake sockeye salmon while recovery efforts are under way. The proposed plan provided the following interim delisting criteria for Redfish Lake sockeye salmon:

“For sockeye salmon, the numerical escapement goal is an eight-year (approximately two-generation) geometric mean of at least 1,000 natural spawners returning annually to Redfish Lake and 500 natural spawners in each of two other Snake River basin Lakes.”

The captive broodstock program will continue its efforts until this interim delisting goal has been achieved or the TRT for Snake River sockeye salmon provides other guidance for captive broodstock program termination.

2. *Procedures and techniques that will be used during the project.*

a. *Method(s) of capture and release:*

Juvenile sockeye salmon are trapped as they emigrate from Stanley basin lakes. Inclined screen traps and screw traps have been and will continue to be, the primary types of traps used to capture emigrating smolts. Handling of captured juvenile sockeye salmon may include any or all of the following: measuring, weighing, PIT tagging, scale and tissue sampling for genetics or disease testing. Fish are anesthetized prior to handling and are allowed to recover prior to being released. Current plans do not include bringing captured juvenile sockeye salmon captured at out-migration into the captive program.

Picket weirs with trap boxes are the primary types of traps used to capture adults. Picket weirs direct the adults into the holding container where they are removed by net or by hand and either released or transferred to an appropriate holding container. A picket weir has been used seasonally on Redfish Lake Creek, 1.4 km downstream from the mouth of the lake since the inception of the program. Fish that are returning to Pettit or Alturas lakes are trapped at the Sawtooth Fish Hatchery weir. The Sawtooth weir directs fish into the adult holding ponds at the hatchery.

b. *Description of tags, tagging method, location, and duration:*

Several tagging methods are employed in this project. Juvenile sockeye salmon are passive integrated transponder (PIT) tagged prior to release from the hatchery and when captured at out-migration traps. Standard PIT tagging methodologies and protocols developed by the Pacific States Marine Fish Commission are followed and PIT tags have been demonstrated to be safe for use in juvenile salmonids and to be reliable over the life of Pacific salmon (Prentice et al. 1990a; Prentice et al. 1990b).

Fish are anesthetized, tagged, and allowed to recover prior to release. Individual disinfected PIT tag needles are used for each fish. Juvenile PIT tag detections at Lower Snake and Columbia river dams are an integral part of the evaluation of juvenile releases because they provide almost immediate feedback on the success of different strategies and valuable information on timing of migration.

In addition to PIT tagging juveniles released to the habitat, all sockeye salmon retained for broodstock are individually identified with PIT tags. These tags allow fish culturists to monitor individual fish growth and track the lineage of individual fish to ensure that only appropriate genetic crosses are made when fish are spawned. Sockeye salmon in the captive broodstock program are PIT-tagged as presmolts and will retain their tag for the remainder of their life.

In addition to PIT tags, coded-wire tags (CWTs) are used to evaluate homing and to identify fish to a specific release strategy. Coded wire tags are stainless steel wires that are injected into the nose cartilage of the fish following procedures described by Jefferts et al. (1963). These tags remain with the fish throughout its life and are recovered from carcasses collected in spawning surveys or from fish spawned at the hatchery.

All juvenile sockeye salmon released as smolts or presmolts are adipose fin-clipped prior to release. This allows juveniles encountered in the lakes to be positively identified as progeny from the captive broodstock program during other sampling activities. In addition to adipose clipping, ventral fin clips have been used to evaluate different release timings or rearing origins.

Radio tags are used to track adult sockeye salmon that are released to the lakes for natural spawning. Radio tagging is conducted in accordance to standard methods, and only a portion of the released fish is tagged.

Floy tags (T-bar anchor type tags) are used to identify full term hatchery adults released to the lakes for natural spawning. These tags allow easy identification of adult origin when adults are encountered during redd counting.

c. Description of type and dosages of any drugs to be used, purpose of use, and method of application:

The captive broodstock program has historically used disinfectants, anesthetics, antibiotics, vaccinations, and antifungal treatments to control pathogens. Because all fish in these captive broodstock programs are ESA-listed and non-foodfish, treatments are excluded from USDA FDA regulations regarding use of treatments. This policy decision was relayed in a letter from USDA to NMFS and USFWS in 1992 and is on file at the IDFG Eagle Fish Health Laboratory and Eagle Hatchery, IDFG. If new diseases or better therapeutic approaches develop, additional drugs prescribed by the captive broodstock program fish pathologist may be administered. Dosage, purpose of use, and method of application for currently used drugs are as follows:

- **Anesthetics:**
Fish at all life stages are anesthetized by being immersed in a Sodium Bicarbonate buffered 50-70 mg/liter solution of MS-222 (Tricaine methanesulfonate).
- **Antifungal treatments:**
A 1,668 mg/liter solution of formalin is dripped into the water supply of incubating eggs for 15 minutes three times per week to control fungus.
- **Antibiotic therapies:**
Erythromycin is administered orally, feeding medicated feed obtained from BioOregon (Warrenton, OR) to produce a dose of 100 mg/kg of body-weight. Salmon will be fed this medicated feed for up to a 28 day period to control bacterial kidney disease. When oral administration is not feasible as with anadromous adults, an intraperitoneal injection of erythromycin is given to fish at a dose of 20 mg/kg of body weight.

Salmon fingerlings are fed Oxytetracycline or oxolinic acid medicated feed at a dose of 75 mg/kg of body weight for 10 days to control outbreaks of pathogenic aeromonads, pseudomonads, and myxobacteria, etc. bacteria as these cases arise.

- **Vaccinations:**
Smolt-sized sockeye are vaccinated prior to shipment to saltwater with intraperitoneal injections of Vibrogen (Aqua Health, Ltd., Charlottown, P.E.I., Canada) to control *Vibrio spp.* and Renogen (Aqua Health Ltd.) to control bacterial kidney disease.
- **Egg disinfection:**
Newly fertilized eggs are water hardened in 100 mg/l solution of Iodophor for 30-60 minutes to inactivate viral and bacterial pathogens on the egg surface and in the perivitelline space. Surface disinfection is repeated after eggs are shocked and picked in preparation for transport.

d. Temporary holding time prior to release of individuals and the manner in which they will be detained:

Holding times vary according to the particular aspects of the project and with the needs of the fish. Juvenile fish trapped at the out-migration traps are held for less than 12 hours in flow through live boxes with locking lids. Releases are conducted near sunset to provide "cover of darkness."

Most of the temporary holding involves transport of hatchery reared juveniles to release sites. This issue will be discussed in Section I of this document.

e. Number and types of samples to be taken from each individual, including sampling protocol:

Sampling regimes are used throughout the program to monitor fish health and to evaluate attainment of program objectives. Length and weight measurements are collected from juvenile fish during routine hatchery procedures (e.g., tagging and sample count activities). As fish mature and become more sensitive to handling, the frequency of handling events is reduced to maturation sorts. This non-lethal sampling is required to monitor fish health, determine feed size, and adjust daily feed rations. The data obtained is also used to evaluate the efficacy of new fish culture methods being employed to improve captive broodstock quality. Sampling procedure protocol includes anesthetizing fish in MS-222, determining their fork length and weight, and then allowing them to recover in their rearing tank.

Tissue samples are collected from mortalities during necropsies on program fish to monitor for the presence of common bacterial and viral pathogens. American Fisheries Society (AFS) "Bluebook" procedures are employed to isolate bacterial or viral pathogens and to identify parasite etiology. All examinations are conducted under the direction of the program fish pathologist. Genetic samples are also collected from mortalities in an effort to develop mitochondrial DNA, and nuclear DNA markers for sockeye salmon populations held in the program.

Sampling of juvenile sockeye salmon captured at out-migration traps may include collection of length/weight data, scales, and tissues. Sampling will be conducted according to standard fisheries science methods and proven techniques developed over the duration of the project. The numbers of juveniles sockeye salmon captured, sampled, PIT tagged and released will vary with the number of out-migrants present, trap efficiency, and project needs. The SBSTOC will play an integral role in decisions regarding numbers to sample, PIT tag, etc.

Adult sockeye salmon trapped at locations discussed in section 2.a. of this document are sampled for length/weight and a fin sample is collected for genetic analysis.

3. *Potential for injury or mortality to the species involved, and steps that will be taken to minimize adverse effects and to ensure that the species will be taken in a humane manner.*

Past experience in this program indicates that juvenile mortality associated with out-migrant trapping, handling, and tagging is low especially when equipment is functioning properly and unforeseen catastrophic events do not occur. Trapping and handling mortality has been 1% or less of total number of juveniles handled during the 2000, 2001 and 2002 out-migration years. Mortality associated with capture, handling, and tagging of juvenile fish is minimized in several ways. Juvenile traps are checked twice daily to reduce length of time fish are in traps, and traps are adjusted nightly based on water levels. All personnel are properly trained in fish handling methods before being allowed to operate traps. All fish are anesthetized prior to tagging and are allowed to recover prior to release.

Rearing of fish for Redfish Lake sockeye salmon captive broodstocks is covered under the current permit application. Fish will be reared in a humane manner in the best possible fish culture environment. Nevertheless, some mortality is expected in any fish culture program. This adverse effect will be minimized by continuing research aimed at

improving captive broodstock quality and increasing egg-to-adult survival as close to 100% as humanely possible. Human error, equipment failure, and pathogens (such as dislodged standpipes in tanks or disrupted water supplies) may cause fish death. Every safeguard needed to eliminate mortality by foreseeable events (back up power generation, alarm systems, emergency oxygen systems, etc.) and fish health concerns (sanitation, hygiene, vaccination, prophylactic treatments) will be taken. Mortality of fish in culture from hatch through maturity has averaged less than 15%.

Maintaining diseased or deformed eggs, juveniles, or adults in the captive broodstock program can have debilitating effects. To minimize the risks of disease transmission, good fish husbandry techniques such as sampling for disease, culling nonproductive or moribund fish, and culling diseased eggs will be followed. Previously established protocols for the management of disease are:

- Fish husbandry protocols must follow standard fish culture practices (for a general overview of methods see Leitritz and Lewis 1976; Piper et al. 1982; FRED 1983; Rinne et al. 1986; McDaniel et al. 1994; Schreck et al. 1995; Pennell and Barton 1996; Wedemeyer 2001). Integrated Hatchery Operation Team, NMFS Interim Standards for the Use of Captive Propagation, and similar guidelines approved by the SBSTOC to ensure high quality rearing conditions.
- Diseased, moribund, or non-productive fish and gametes should be removed from the captive population and disposed of following AFS Fish Health Blue Book and Pacific Northwest Fish Health Protection Committee guidelines to ensure overall health of rearing groups. This culling is necessary to prevent the spread of contagious diseases to remainder of the population.
- Gametes, embryos, or fish may be sampled as necessary to detect diseases and to monitor fertilization and development of embryos. This lethal sampling is necessary to improve the reproductive success of fish in the captive broodstock program.
- Diseased eggs and fish that are culled must be disposed of per the permit requirements for the disposal of ESA-listed Snake River sockeye salmon if there is not a research, educational, or public outreach purpose identified.
- The annual report for the permit shall summarize the number, life stage, and condition of all fish or eggs culled or disposed of from the Snake River sockeye salmon captive broodstock program.

To ensure high quality eggs, juveniles, and adults in the captive broodstock program, we will follow the above protocols and SBSTOC approved guidelines for fish sampling, culling diseased fish, and maintaining healthy populations.

H. Description and Estimates of Take:

- 1. A list of each species and/or population and/or Evolutionarily Significant Unit (ESU) to be taken including the common and scientific name. Include specific population or subpopulation groups if appropriate.***

Estimates of take reflect the focus of this project on the Snake River sockeye salmon ESU (*Oncorhynchus nerka*; Table 6). When the program was started in 1991 Redfish Lake was the only lake remaining in the Snake River Basin, which had a population of sockeye salmon remaining. Although Redfish Lake is the focus of this permit two other lakes, Pettit and Alturas lakes, have had juvenile sockeye salmon reintroductions from the captive broodstock program and are providing juvenile rearing habitat for hatchery sockeye salmon. In addition, observations and collections may take place in the upper Salmon River or on outlet streams of Redfish, Pettit, or Alturas lakes.

We have included Snake River spring chinook salmon (*Oncorhynchus tshawytscha*) and wild steelhead trout (*O. mykiss*) in our estimates of take (Table 6). Juvenile chinook salmon and steelhead are encountered during out-migrant trapping although in low numbers relative to sockeye salmon juveniles. Wild/natural adult chinook salmon may be observed/captured/released during observations or capture operations for adult sockeye salmon.

2. *Sampling schedule, including location and dates if available.*

Juvenile sockeye salmon will be sampled concurrent with out-migration, which occurs from early April through early June at the location described in section 2.a. of this document. Adult sockeye salmon will be sampled at adult weirs. Adult sockeye salmon are in the upper Salmon River from early July through September at locations described in section 2.a. of this document. Adult chinook salmon are also in the upper Salmon River during July and may be encountered. Juveniles and adult sockeye salmon in culture are sampled as necessary at the rearing location.

3. *Description of recent status and trends of each species and/or population and/or ESU to be taken, relative to the location(s) or area(s) of taking.*

Wild/natural (unmarked) sockeye salmon smolt production estimated at the juvenile out-migration trap on Redfish Lake Creek has varied from a low of 110 smolts in 2001 to over 3,400 smolts in 2002. Unmarked out-migration varies depending on supplementation numbers of eyed-eggs or mature adults to the lake. The marked hatchery component (from presmolt releases) varies depending on number of fish released and on overwinter survival. Estimated numbers of marked smolts out-migrating from Redfish Lake has varied from a low of 7,000 fish in 2000 to over 28,000 in 1998. Adult returns reached a low of zero adults in 1997 to a high of 257 in the year 2000. Adult returns since 1999 have been supported entirely by hatchery supplementation efforts.

4. *Description and/or completed summary table of estimated take per annual period, for your activities at each discrete location and/or for each project.*

Proposed annual take of Snake River sockeye salmon (*Oncorhynchus nerka*), spring chinook salmon and wild/natural steelhead by Idaho Department of Fish and Game for Research and Enhancement activities (Table 6).

Table 6. Anticipated annual take of listed Snake River sockeye and spring chinook salmon and wild/natural steelhead trout.

Type of take		Juvenile	Adult
<u>Redfish Lake/ Redfish Lake Creek</u>			
sockeye salmon	Observe/harass	na	600
sockeye salmon	capture/handle/release	40,000	300
sockeye salmon	capture/handle/tag/release	6,000	50
sockeye salmon	capture/handle/tag/retain	0	200
sockeye salmon	lethal take	400	0
sockeye salmon	spawning/dead/dying	Na	100
sockeye salmon	indirect mortality	800	20
spring chinook salmon	capture/handle/observe/release	250	75
wild/natural steelhead trout	capture/handle/observe/release	250	30
<u>Pettit/Alturas lakes and upper Salmon River</u>			
sockeye salmon	observe/harass	Na	600
sockeye salmon	capture/handle/observe/release	24,000	300
sockeye salmon	capture/handle/tag/release	6,000	50
sockeye salmon	capture/handle/tag/retain	0	100
sockeye salmon	lethal take	400	0
sockeye salmon	spawning/dead/dying	Na	200
sockeye salmon	indirect mortality	800	20
spring chinook salmon	capture/handle/observe/release	250	75
wild/natural steelhead trout	Capture/handle/observe/release	250	30

5. Estimates of potential annual mortalities by take category, including a justification. You should specify the life stage of the potential mortalities, sex if known, and whether naturally-produced (wild) or artificially-propagated (hatchery).

Annual take estimates reflect the flexibility necessary to accommodate anticipated changes in the numbers of juveniles and adults produced. This estimated take includes artificially and naturally produced ESA-listed sockeye salmon. The observe/harass category reflects numbers of adults that we estimate will be encountered on spawning ground surveys. The capture/handle/release category reflects anticipated numbers of adults and juveniles that may be encountered during trapping operations focused on that life stage. The capture/handle/tag/release category reflects numbers of juveniles that may be PIT-tagged during out-migration and the number of adults that may be fitted with radio-tags or external tags for spawning observations. The capture/handle/tag/retain category is for individuals that will be brought into captivity and incorporated into the captive broodstock mating design. At the present time, there are no plans to bring any juveniles into captivity. The lethal take of juveniles is for disease sampling and whole body proximate analysis that is currently being used to evaluate fish health, inter-annual variability in lake productivity and changes in fish culture practices that contribute to overwinter survival and out-migration success. The indirect mortalities category is for any mortality associated with fish transfers. This category is expected to be very low when all equipment is functioning properly. The juvenile spring chinook salmon and wild/natural steelhead estimates of take are for out-migrant trapping activities. Adult chinook salmon may be encountered during any activity involving adult sockeye salmon in the upper Salmon River or outlet streams from Stanley basin lakes.

6. Provide details on how all take estimates, including mortalities, were derived.

Estimates of take are based on historical records and estimated future take. Numbers of juvenile sockeye salmon captured/handled at out-migrant traps is based upon numbers of juvenile sockeye salmon supplemented the previous year, water flows, and trap efficiencies. Adult numbers include both returning anadromous adults and adults reared to maturity in the captive broodstock program and released to the lakes for natural spawning. Indirect mortalities were estimated based on historical records associated with fish transfers. Lethal take mortalities are based on projected monitoring needs associated with prerelease and outmigration sampling for disease and body condition analysis.

I. Transportation and Holding

1. Transportation of a Listed Species

Transportation of sockeye salmon can include: shipment of eyed-eggs between IDFG and NMFS rearing facilities; transportation of presmolts, smolts, or adults for release into Stanley basin lakes from IDFG and cooperator facilities; and the transport of anadromous adults from trapping facilities to temporary IDFG holding facilities until release for volitional spawning in Stanley basin lakes or transportation to an IDFG facility for spawning. The IDFG obtains the appropriate permits for interstate transfer of captive sockeye salmon to and from NMFS facilities and/or other cooperator facilities. Travel arrangements are coordinated well in advance to ensure safe and efficient transfer of fish between rearing sites, trapping sites, and release sites.

a. Mode of transportation and name of transport company, if applicable:

Live fish or egg transfers occur in a variety of program vehicles including customized pick-up trucks and standard fish transportation trucks. Shipment of eggs from the Redfish Lake captive broodstock program to the NMFS Burley Creek facility will normally be by a common air carrier that provides service from Boise to Seattle. Horizon Air has a demonstrated track record of successfully shipping eggs from Boise, Idaho to Seattle, Washington and vice versa. Upon arrival, a receiving party will transport the eggs to their final rearing location.

b. Length of time in transit for the transfer of the individual(s) from the capture site to the holding facility or to the target location:

Adults sockeye salmon captured at the Redfish Lake Creek adult trap or the Sawtooth Hatchery weir are held at Sawtooth Hatchery for temporary holding. Transport time from the trap site to Sawtooth Hatchery may be as long as ½ hour.

c. Length of time in transit for any planned future move/transfer of the individual(s):

The following scenarios describe anticipated moves and transfers associated with this project.

Eagle FH to Sawtooth FH: egg transfers by truck ≈ 4 hours

Eagle FH to NMFS facilities: egg transfer by air, total time \approx 5 hours
Eagle FH to NMFS facilities: juvenile and adult transfer by truck \approx 14 hours
Eagle FH to Stanley basin lakes: eggs, juveniles, adults by truck \approx 5 hours
NMFS facilities to lakes: eggs by air and truck \approx 9 hours
NMFS facilities to lakes: juveniles and adults by truck \approx 17 hours

d. *Qualifications of the common carrier or agent used for transportation of the individual(s):*

Transportation is conducted by IDFG personnel or cooperators. See section 5.6 for qualifications of personnel transporting sockeye salmon eggs, juveniles, and adults.

e. *Description of the pen, tank, container, cage, cradle, or other devices used, both to hold the individual(s) at the capture site and during transportation:*

The containers used to transport fish will vary based on the task. In all cases, containers of the proper size and configuration will be used for the task at hand. Fish will be maintained in water of the proper quality (temperature, oxygen and chemical composition) as much as possible during handling and transfer phases of transportation. Containers will vary from five gallon plastic buckets and 100 L locking coolers for short term holding, to sophisticated truck-mounted tanks for long distance/duration transfers. Eyed-eggs may be transferred from NMFS facilities to IDFG facilities and/or between IDFG facilities. Eyed-eggs are packed at a conservative density in perforated shipping tubes (27-cm long by 6-cm diameter at approximately 2,000 eggs per tube), capped, and labeled to identify the number of eyed-eggs. Tubes are wrapped with hatchery water-saturated cheesecloth and packed in small, insulated coolers. Ice chips are added to ensure proper temperature maintenance and coolers are sealed with packing tape. Eggs are monitored hourly during transportation.

Fish are transported to and from rearing locations, release locations, and adult trapping facilities in truck mounted, insulated tanks (typically 1,136 L capacity) with alarm, back-up oxygen systems, and "fresh flow" mechanical water movement units on board. The vehicle and containers used is dependent upon the size and number of fish and the distance to be hauled. For longer duration trips (e.g., from NMFS Washington facilities to Idaho), truck-mounted tanks are available to the program with 1,136 L (300 gal), 3,785 L (1000 gal), and 9,463 L (2,500 gal) capacities. Transport guidelines are in place to not exceed 119 g/L (1.0 lb/gal). All trucks are equipped to provide appropriate conditions to facilitate safe transport of fish to the specified destination. All vehicles are equipped with two-way radios and cellular phones to provide routine or emergency communications. Fish are monitored regularly during transportation.

f. *Special care before, during, and after transportation (e.g., use of oxygen, temperature control, anesthetics, antibiotics, etc.)*

Project leaders ensure that fish transport is conducted to provide the best possible conditions for safe transfer of fish between destinations. Pathology and fish culture experts provide guidance on all fish transportation events.

Disease histories of brood groups are reviewed and evaluated before, during and post transportation by program pathologists.

Prior to transport, fish are fasted for 48 hours to reduce metabolic demand and stress. Transport guidelines are in place to not exceed 119 g/L (1.0 lb/gal). Tanks on transport trucks are disinfected and filled with clean well water prior to transportation. All vehicles are equipped to provide the appropriate conditions (temperature, oxygen, capacity) to ensure the safe transport of fish to and from specified locations. Water temperature in transport tanks is maintained at levels necessitating minimal tempering between source and destination temperatures. In addition, all vehicles are equipped with two-way radios or cellular phones to provide routine or emergency communication capability. Prior to releasing transported fish at hatchery or remote release locations, transport and receiving water temperatures are tempered to within 2.0°C of each other.

2. *Holding of a Listed Species*

The IDFG Eagle Fish Hatchery is the primary site for the sockeye salmon captive broodstock program. Annual spawning designs are developed to maximize genetic diversity and minimize risks associated with selection, inbreeding, and genetic drift. Eyed-eggs are selected from sub-families to create annual broodstocks based on genetic criteria developed by the program geneticist. An identical copy of eyed-eggs is transferred to the NMFS Burley Creek facility for rearing. The NMFS maintains this safety net broodstock for egg production to provide for releases of eyed-eggs, presmolts, smolts, or pre-spawn adults. Additionally, IDFG's Sawtooth Fish Hatchery personnel and facilities have been used continuously since 1991 for various aspects of the sockeye captive broodstock program including: 1) pre-spawn anadromous adult holding, 2) egg incubation, and 3) juvenile rearing for pre-smolt and smolt releases. Captive fish are reared using standard fish culture practices and approved therapeutants (for an overview of standard methods see Leitritz and Lewis 1976; Piper et al. 1982; Erdahl 1994; Bromage and Roberts 1995; McDaniel et al. 1994; Pennell and Barton 1996).

a. Dimensions of the pool(s) or other holding facilities and the number of individuals, by sex, age, and species to be held in each.

Eagle Fish Hatchery—Facility layout at Eagle Fish Hatchery remains flexible to accommodate the various life stages on station. Several holding containers are used to culture sockeye salmon eggs to the adult stage including: 0.014 m diameter circular incubators (2.5 L); 0.7 m diameter semi-square tanks (0.091 m³); 1.0 m diameter semi-square tanks (0.302 m³); 2 m diameter semi-square tanks (1.420 m³); 3 m diameter circular tanks (6.50 m³); and 4 m diameter semi-square tanks (8.89 m³). Incubators are used for incubating eggs after fertilization to swim-up. Typically, 0.7 m and 1 m tanks are used for rearing fry from ponding to approximately 1.0 g. Two and 3 m tanks are used to rear juveniles to approximately 20 g and 1,000 g. Age-3 fish are transferred to 6 m tanks until they reach maturation.

NMFS Manchester Marine Laboratory—The NMFS facility rears fish from the Snake River Sockeye Salmon captive broodstock program under a separate permit. For

information on the facilities involved, see permit # 1148 issued to the NMFS Northwest Fish Science Center.

Sawtooth Fish Hatchery—Eyed-eggs received at Sawtooth Fish Hatchery from Eagle Fish Hatchery or NMFS are incubated in vertical trays. Fry are ponded to 0.7 m fiberglass tanks. Juvenile sockeye salmon (>1 g) are held in vats or in a series of 2.0 m fiberglass tanks. Juvenile sockeye salmon reared at Sawtooth Fish Hatchery are released as presmolts or smolts. Pre-spawn anadromous adults captured at Redfish Lake Creek or Sawtooth Fish Hatchery weirs are held in vats until release for natural spawning or transfer to the Eagle Fish Hatchery for spawning.

Rearing densities at all facilities are not permitted to exceed 8 kg/m³. Tank discharge standpipes are assembled in two sections (“half pipe principle”) at all facilities to prevent tank dewatering when removed for tank cleaning. Shade covering (70%) and jump screens are used where appropriate.

b. Water supply, amount, and quality, including controls on temperature and dissolved oxygen:

Eagle Fish Hatchery—Specific pathogen-free artesian water from three wells is used, and artesian flow is augmented with four separate pump/motor systems. Flow to all tanks is maintained at no less than 1.5 exchanges per hour. Ambient water temperature remains a constant 13.5°C and total dissolved gas averages 100% after degassing. Water chilling capability was added in 1994, and is used during the early incubation of juvenile sockeye salmon. Using a water chilling system, ambient water temperature is reduced to between 10.0°C and 11.0°C. Backup and system redundancy is in place for degassing, pumping, and power generation. Oxygen is available on-site for emergency supply to all rearing tanks. Eight water level alarms are in use and linked through an emergency service operator. Additional security is provided by limiting public access and by the presence of four on-site residences occupied by IDFG hatchery personnel.

NMFS Manchester Marine Laboratory—The NMFS facility rears fish from the Snake River Sockeye Salmon captive broodstock program under a separate permit. For information on the facilities involved, see permit # 1148 issued to the NMFS Northwest Fish Science Center.

Sawtooth Fish Hatchery—Sawtooth Fish Hatchery receives fish culture water from the Salmon River and three production wells. Rearing water from the river enters an intake structure located one-half mile upstream from the hatchery building, and flows through a 54-inch pipe to a control box located in the hatchery building for final screening. This water is then distributed to the indoor vats, outside raceways or adult fish facility. Incubation and early-rearing water is provided by two production wells. Excess well water is spilled into the control box for use in the outside raceways. A third well provides tempering water introduced at the river intake to reduce winter icing problems. Sawtooth Fish Hatchery wells provide 3.1 cfs of pumped water and temperatures range from 4°C (39°F) in the winter to 11°C (52°F) in the summer. Backup and redundancy water systems are in place.

c. Amount and type of diet used for all individuals, and food storage:

Fish are fed a standard commercial diet produced by BioOregon (Warrenton, Oregon) until they reach approximately 150 g, after which time they receive a special brood diet enhanced with natural flavors from fish and krill. To help offset precocial development of male program fish, diet ration and water temperature are manipulated to provide reasonable environmental conditions and acceptable growth modulation. Feeding regimes have been developed (collaboratively with NMFS, Project No. 199606700) to adjust ration seasonally to simulate natural conditions. To track growth and to ensure that projected weights track closely with actual weights, periodic routine inventories are conducted. Fish are anesthetized, weighed to the nearest 0.1 g, and measured to the nearest 1 mm fork length. All feed is stored in freezers that maintain an average temperature of -20°C .

d. *Sanitation practices used:*

Stringent disinfection and sanitation protocols are in place at all sockeye salmon rearing facilities. All fish holding containers (coolers, truck tanks, rearing tanks) will be disinfected and rinsed prior to receiving fish. All holding tanks are affixed with sumps, which collect and hold excess food and waste and prevents excessive contact between waste and the fish. Additionally, incubation tanks are siphoned and post-incubation tanks are brushed to remove food and waste that is not collected in the sumps. Separated equipment (e.g. brushes, nets, buckets) is used for each group. All equipment is disinfected in 100 ppm iodine. Efforts are made to minimize stress to the fish associated with cleaning activities.

e. *General fish culture and spawning protocols:*

Historically, maturation has been determined solely by changes in skin sheen, skin coloration, and body morphology approximately four weeks prior to spawning. As of the summer of 2002, ultrasound scanning technology was used to determine maturation status of fish. Ultrasound allows program staff to determine maturation earlier than waiting for development of physical changes by maturing fish. Earlier maturation detection allows for pre-spawn planning (*i.e.*, number of mature females expected, projected egg numbers, etc.). We plan to continue using this technology in the future.

Mature captive broodstock salmon are anesthetized with MS-222 and checked for ripeness on a weekly basis during the spawning season, typically after October 1. Hormone implants (gonadotropin releasing hormone analog [GnRHa]) are injected into the dorsal sinus of some unripe fish to expedite ovulation and spermiation to coordinate spawn timing between males and females (Swanson 1995). Females that are ready to spawn, as determined by egg expression, are humanely killed and have their PIT tag code, fork length, and weight recorded. Females are then bled by cutting the caudal peduncle to the depth of the caudal artery. Bleeding is a standard procedure done to limit the amount of blood accumulating with the eggs that might clog the eggs' micropyle and reduce fertilization. Females are bled for 5-10 minutes and then abdominally incised with a sterile spawning knife. The free flowing eggs are manually stripped and collected in a plastic bag. The eggs from each female are divided into three sub-families. Males that are used for spawning are live or dead spawned, depending on the need for their reuse on future spawning dates. In either

case, milt is expressed into Whirl-pak bags by compressing the ventral surface. Milt quality and motility is checked with a microscope.

Mating strategies are structured to maintain genetic diversity. These strategies include: dividing the female into three sub-families and fertilizing each sub-family with a different male; attempting representation of individual fish equally; avoidance of pairing between close siblings, fertilization between different year classes and fertilization with cryopreserved sperm from other generations as suggested by Hard et al. (1992). Specific mating protocol matrices for individual year classes and lineages are developed by geneticists in consultation with the SBSTOC.

Eggs are fertilized following “dry method” procedures. Milt from one male is poured into the plastic bag containing approximately one-third of the eggs of one female (1 sub-family). The milt is gently worked into the eggs for a several seconds, saline solution (85 mg/L NaCl) is added to activate the sperm, and the eggs are agitated to distribute the activated milt. The bag is left undisturbed during the initial stages of the fertilization process. After approximately two minutes, the eggs are water hardened in a 100ppm buffered Iodophor solution for 30 minutes and placed in up-flow containers for isolated incubation. Beginning two days after fertilization, the eggs are treated with a formalin drip into the water supply (1,668 mg/L for 15 minutes three times per week) for control of *Saprolegnia* spp. The eggs are left undisturbed from the sensitive period at 48 hours after fertilization until they have reached the eyed stage. When the eggs have eyed, they are shocked. Dead or unfertilized eggs are removed and counted to determine fertilization rates.

Spawning adults are analyzed for common bacterial and viral pathogens, such as bacterial kidney disease (BKD), infectious hematopoietic necrosis virus, and viral hemorrhagic septicemia. Tissue samples are collected from the kidney, spleen, and pyloric caeca of each fish and ovarian fluid samples are collected from each female and analyzed at the Eagle Fish Health Laboratory. Results of fish health analysis of spawners will be used by IDFG and the SBSTOC to determine disposition of eggs and subsequent juveniles.

Fish health is checked daily by observing feeding response, external condition, and behavior of fish in each tank as initial indicators of developing problems. In particular, fish culturists look for signs of lethargy, spiral swimming, side swimming, jumping, flashing, unusual respiratory activity, body surface abnormalities, and unusual coloration. Presence of any of these behaviors or conditions is immediately reported to the program fish pathologist. The presence of moribund fish is immediately reported to the fish pathologist for blood and parasite sampling. A fish pathologist routinely monitors captive broodstock mortalities to try to determine cause of death. When a treatable pathogen is either detected or suspected, the program fish pathologist prescribes appropriate prophylactic and therapeutic drugs to control the problem. Dead fish are routinely analyzed for common bacterial and viral pathogens, e.g., bacterial kidney disease, infectious hematopoietic necrosis virus, etc. Select carcasses may be appropriately preserved for pathology, genetic, and other analyses. After necropsy, specimens that are not vital to further analysis are disposed as described of in Section 5 of this document.

All captive broodstock rearing protocols and activities are coordinated through the SBSTOC. Daily staffing at fish rearing facilities is provided by IDFG.

3. *Emergency contingencies*

Daily staffing is provided for protective fish culture of Redfish Lake sockeye salmon throughout the normal workweek and weekends. Electronic security and facilities monitoring are continuous (see above, Section I.2).

The captive broodstock programs rearing experience has shown that occasionally groups of fish will have unacceptably high pathogen levels. When epidemic levels of pathogens are detected in eggs or juvenile fish being reared for release, a decision to destroy or release must be made. The IDFG mandates that if IHN is detected in a group of sockeye salmon they will not be released back into Stanley basin lakes. It is vitally important that an alternative release site must not allow IHN positive individuals to become vectors to the Stanley basin populations. If such a location cannot be identified then it will become necessary to destroy these fish. Current IDFG bacterial kidney disease (BKD) management guidelines for sockeye salmon allows eggs and fish from parents with enzyme-linked immunosorbent assay (ELISA) values between 0.2 (0.12) - 0.4 (0.20) (using current Kerkagard-Peny Laboratories antibody lots) to be returned to Idaho for release in Stanley basin lakes. Fish from parents with ELISA values of 0.2-0.4 can be reintroduced as eyed-eggs to Pettit or Alturas lakes or reared outside of Idaho as smolts for release to lake outlet streams, if a pre-release sample of 60 fish per lot has no more than 5% of samples with ELISA OD values greater than 0.2 (0.12) and no epizootics due to clinical BKD have occurred. However, when the presence of BKD is detected in these subsamples or parental values are greater than 0.4, the SBSTOC and IDFG will not permit the fish to be returned to Idaho. As with IHN infections, if no alternate release location can be found that ensures these fish will not spread BKD to the healthy population, they will be destroyed. Similar decision trees for other types of virulent pathogens detected in captive broodstock population will be made as the need arises.

J. *Cooperative breeding program.*

The Redfish Lake sockeye salmon captive broodstock programs is a cooperative breeding program between IDFG, NMFS, BPA, the Shoshone-Bannock Tribes, and others involved in salmon recovery in the Pacific Northwest. The Idaho Department of Fish and Game is willing to maintain or contribute data to a captive breeding program if such action is requested.

K. Previous or Concurrent Activities Involving Listed Species.

- 1. Identify all previous permits where you were the permit holder or primary investigator working with federally-listed species.**

Permit Number	Species	Purpose
776,795,1120	Sockeye salmon	Captive brood stock program
823,1124	Sockeye, chinook salmon	Research activities
844, 1233	Sockeye, chinook salmon	Fisheries activities
869,908,1188	Sockeye, chinook salmon	Sport fishing
972,1010	Chinook salmon	Captive rearing program
832,903	Chinook salmon	Idaho Power Hatcheries
919	Chinook salmon	Sawtooth Fish Hatchery
920	Chinook salmon	East Fk. Salmon River Trap
921	Chinook salmon	McCall Fish Hatchery
922	Chinook salmon	Pahsimeroi Fish Hatchery

- 2. For the above permits, list all mortality events of listed species that have occurred in the last five years.**

- a. List the species, including scientific name and population where applicable.**

- b. Describe the number and cause of mortalities.**

Permit No.	Species	Incident	Cause	Number of Mortalities
903	ESA-listed spring chinook	Loss of adult spring chinook salmon on May 20, 1997 at IDFG Oxbow Fish Hatcheries Hells Canyon Trap.	Combined mechanical failure and high turbid water	5
1010	ESA-listed spring chinook	Loss of 118 juvenile chinook salmon on May 10, 1997 at IDFG Eagle Fish Hatchery	Loss of water flow to one rearing tank due to algae plug	118
1120	ESA-listed sockeye salmon	Loss of juvenile sockeye salmon at IDFG Sawtooth Fish Hatchery—May 2001	River otter predation	93

- c. Describe the measures that have been taken to diminish or eliminate such mortalities, and the effectiveness of those measures.**

In all cases, facility protocols have been modified to avoid repeat occurrences of the above incidents. Oxbow Fish Hatchery staff have not experienced an adult chinook salmon mortality event since implementing new policy. During high flow, turbid conditions, trap staffing has been increased to address the increased effort need to insure the safety of adult chinook salmon. Eagle Fish Hatchery staff routinely inspect water lines throughout the year to prevent algae mats from going undetected. Water lines are also flushed frequently to address this issue. Perimeter fencing has been installed around raceways when sockeye salmon are being held at Sawtooth

Hatchery to prevent loss to river otters. No otter mortality has occurred since this modification was implemented.

L. Certification:

I hereby certify that the foregoing information is complete, true, and correct to the best of my knowledge and belief. I understand this information is submitted for the purpose of obtaining a permit under the Endangered Species Act of 1973 (ESA) and regulations promulgated thereunder, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or to penalties under the ESA.

Signature

Date

Name and Position Title

ATTACHMENT I

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